

Griessmann, Knoblauch, Thomas, and others. As the result of a careful weighing of these various experiments, the authors present the following formula connecting the total heat of one pound of dry saturated steam with its temperature (Fahrenheit):—

$$H = 1150.3 + 0.0045(t - 212) - 0.000550(t - 212)^2.$$

The equation heretofore in use was $H = 1082 + 0.305t$, which may also be put in the more directly comparable form of

$$H = 1147 + 0.305(t - 212).$$

It will be seen that there is a considerable difference in form between these two statements, although as one is of the second degree and the other of the first it is not easy to tell at sight by how much they would differ over the working range. The best way of comparing them is to set the figures in the old steam tables side by side with those in the new. This we have done for each increase of 50 lb. in the pressure. The figures in brackets are those of the old tables, as taken from such a standard book as Perry's "Steam Engine," and the remaining figures are those of the tables now published.

Pressure lb./in. ²	Tempera- ture ° F.	Sp. Vol. Cu. Ft. per lb.	Latent Heat	Total Heat	Entropy of Steam
1	101.83 (102)	333.0 (334.2)	1034.6 (1043)	1104.4 (1113.0)	1.9754 (1.987)
50	281.0 (280.8)	8.51 (8.34)	923.5 (916.6)	1173.6 (1167.6)	1.6581 (1.649)
100	327.8 (327.6)	4.429 (4.356)	888.0 (882.9)	1186.3 (1181.8)	1.6020 (1.596)
150	358.5 (358.2)	3.012 (2.978)	863.2 (860.6)	1193.4 (1191.2)	1.5692 (1.569)
200	381.9 (381.6)	2.290 (2.273)	843.2 (843.4)	1198.1 (1198.3)	1.5456 (1.545)
250	401.1 (401)	1.850 (1.84)	826.3 (—)	1201.5 (1204)	1.5276 (1.526)
300	417.5 (417.5)	1.551 (1.55)	811.3 (—)	1204.1 (1208.9)	1.5129 (1.515)

It will be seen that at the ordinary steam-engine pressures of 150 to 250 lb./in.², there is very little difference between the two sets of figures, but that at lower pressures there is some variation, although in no case is it extreme. On the other hand, many calculations involve the estimation of differences of heat content, and in those cases it is essential to allow for any such corrections in the received steam tables. It is, therefore, hardly too much, perhaps, to suggest to those who have made important calculations with the old tables that they should recalculate their results on the basis of these later figures.

Anyone reading carefully what the authors are able to say in support of the figures they give must concede that their researches have produced tables based on what is probably the most accurate data procurable at the present time. The theory of the steam engine will be considerably aided thereby, and one cannot but regret that there are no tables of equal accuracy applicable to the working fluid in the internal-combustion engine.

We regret that the authors should have presented the bulk of their results in the unscientific Fahrenheit scale. All who know the pitfalls which beset the paths of students will agree that, of them all, the most common and dangerous is the elusive

"32" in the Fahrenheit scale. To have such a constant is never of any use, and its avoidance is the great merit of the centigrade scale. We should like to see these tables published throughout in the scientific temperature scale.

The book contains two sheets of very useful curves, which enable large numbers of simple problems to be solved by mere inspection. Among the illustrations given we quote the following:—

(a) A vessel of 4 cu. ft. capacity contains 0.2 lb. of water and 0.8 lb. steam. What is the pressure?

(b) What is the entropy of 1 lb. of steam at 100 lb. pressure and 450° F.?

(c) Steam of 140 lb. pressure, superheated 120° F., expands adiabatically with a ratio of expansion of 6. What are the pressure and quality at the end of expansion?

(d) Steam at 100 lb. pressure, superheated 60° F., expands in a nozzle to a pressure of 2 lb./in.². What is its final velocity?

(e) Steam in a throttling calorimeter with a pressure of 17 lb./in.², and a temperature of 265° F. The initial pressure of the steam was 100 lb./in.². What was its initial quality?

It will be admitted that the ready facility with which such problems can be solved by two simple sheets of curves is a great gain, and many workers in science and engineering will be thankful for this help.

H. E. WIMPERIS.

SNAKE VENOMS.

SNAKE VENOMS. An Investigation of Venomous Snakes, with Special Reference to the Phenomena of their Venoms. By Dr. Hideyo Noguchi. Pp. xvii+315. (Washington: Carnegie Institution of Washington, 1909.)

IT is now forty years since Fayrer and Weir Mitchell laid the experimental foundations of knowledge of the chemical characters and physiological actions of snake venoms, their investigations being inspired largely by the desire to combat the high annual death rate from snake-bite. The study of snake venoms has, however, obtained a greater interest since the publication, about fifteen years ago, of observations demonstrating the possibility of producing a high degree of immunity in animals and proving the antidotal properties of the serum of the immunised animals. These phenomena in regard to snake venoms, having been brought into line with similar phenomena in regard to bacterial toxins especially, have been bound up with, and have contributed largely to, the elucidation of the problems of immunity which have in so many directions influenced modern medical thought. Hence there has arisen in regard to snake venoms a literature of high importance, and, from its involving scientific investigators in many countries, a literature necessarily extensive and dispersed.

As the author of this book states, there is at this time, in the English language, no single work which treats of the zoological, anatomical, physiological, and pathological characteristics of venomous snakes with special reference to the properties of their venoms. As something more than a mere summary of the position

of the present knowledge concerning snake venoms, Noguchi's publication merits high praise, and it possesses in addition a vitality which can belong to such a work only when its author has taken a living part in the researches by which this knowledge has been acquired.

It is impossible here to do more than indicate the scope of the book. The earlier sections deal especially with the morphology and geographical distribution of venomous snakes, and with the description of their poison apparatus. The toxic secretions, their physical and chemical properties, and the effects of various physical and chemical agents upon them are then discussed. A summary is given of the symptoms produced by snake-bite in man and by experimental poisoning in animals, and the intimate nature of these effects on the different systems is then taken up in detail. The last sections deal with the problems of immunity to venoms—artificial immunisation, the specificity and therapeutic value of antivenins, the interaction between venom and antivenin, natural immunity, and the treatment of snake-bite.

It may be pointed out that the logical sequence of the last chapters is marred by the somewhat irrelevant interpolation of sections on the effects of venom on cold-blooded animals, plants, &c., between the chapter on natural immunity and that on the treatment of snake-bite. We believe improvement would be obtained by considerable rearrangement of the order of the sections.

The book contains many excellent illustrations, especially of the different species of venomous snakes, their anatomical features, and the pathological changes induced in the tissues by venoms. Several of the illustrations are reproduced from Fayrer's classic work, but many are original. For a book so well illustrated, the binding, in the form we have seen it, is inadequate.

As being the most important practical outcome of the researches epitomised in this publication, the problems concerned with the treatment of snake-bite call for special mention. In regard to the nature of antidotism, Noguchi definitely adopts the view, first propounded, and supported by convincing proof, by Fraser, that this antidotism is not of the nature of a vital action, but of a chemical reaction, between the antivenin and the venom. This view has subsequently been adopted by Calmette, who at first insisted on its being a vital process, and also by Ehrlich in relation to the closely allied antidotism of pathogenic toxins by antitoxins. In its relation to venoms it has also received further support from experiments by Martin and Cherry, and by Stephens and Myers, respectively summarised in pp. 248 and 140 of Noguchi's book.

With respect to treatment, the author chiefly favours specific treatment by antivenins, and expresses the hope and expectation that sufficiently powerful antivenins may yet be produced to cure more severe cases of snake-bite than can yet be done. He emphasises the necessity, as Fraser had experimentally demonstrated, of using large quantities of antivenin, a general principle now being extended to the therapeutic use of antitoxins in disease. He places in a subordinate position all non-specific agents, such as permanganate of potash or chloride of gold, the anti-

dotal effects of which he believes to be very restricted, but still of some value as being quickly and conveniently applicable.

We may further mention that the book contains a good workable bibliography. It is a book which will be of great service to future investigators.

THE EVOLUTION OF MAN'S STRUCTURE.

History of the Human Body. By Prof. H. H. Wilder. Pp. xii+573. (New York: Henry Holt and Company, 1909.) Price 3 dollars.

PROF. WILDER defines the twofold purpose of his book, as, "*first*, to present the results of modern anatomical and embryological research relative to the human structure in a form accessible to the general student, and, *secondly*, to furnish students of technical human anatomy with a basis upon which to rest their knowledge of details;" and there can be no doubt that, as the founder of a village newspaper would express it, he has "supplied a long felt want."

So much technical knowledge has to be acquired by the modern medical student in the brief span of time between matriculation and graduation that there is an ever-insistent tendency to curtail the preliminary scientific subjects in the medical curriculum. The effects of a scamped education in biology are becoming more manifest every year in the writings of anatomists and physiologists, when, as so often happens, the results of long and arduous researches are thrown away for the lack of a modicum of zoological or morphological knowledge.

Prof. Wilder's book, if placed in the hands of the medical student, will help him to bridge the gap between his biological and anatomical studies, and, in the later stages of his career, will help to save him from solecisms such as are being perpetrated far too frequently at the present time.

The wide scope of the work is indicated by the titles of its chapters, which deal with "the continuity of life," "the phylogenesis of vertebrates," "the ontogenesis of vertebrates," the integumentary, skeletal, muscular, digestive (and respiratory), vascular, urogenital, and nervous systems, the sense-organs, and "the ancestry of vertebrates," and an appendix on the classification of vertebrates.

The first chapter explains the fundamental principles implied in the terms phylogenesis and ontogenesis, which form the subjects of the second and third chapters respectively.

The account given in these three chapters (*a*) of the factors which played some part in the evolution of man, and (*b*) of the line of man's ancestry, is lucid, and, on the whole, satisfactory. The author has entirely failed, however, to realise and to set forth the immense importance which must be assigned to the Dipnoi in supplying evidence for explaining the evolution of the Amniota.

In chapters iii. to xi. (inclusive) the author has clearly stated the facts of comparative anatomy which throw light upon the morphology of the various systems of the human body, which I have already enumerated. These portions of the work are of considerable value, not only to the student of human